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Adjacent segment disease: fact or fiction? *medico-legal implications*

In medico-legal practice we see a lot of people with vertebral injuries and disc/soft-tissue injuries. There are frequently discussions on the cause of the claimant's pain and whether it is related to a specific injury or incident or whether it is part and parcel of their constitutional condition. It is well accepted by surgeons who regularly see and assess patients with back pain in their clinical practice that the vast majority of patients with low back pain do not have a specific cause for that pain and we label them as having non-specific low back pain (NSLBP). However, during the process of litigation we are sometimes challenged to give an opinion on the prognosis of claimants who have undergone spinal fusion surgery.

There are three groups of claimants that we might see during the process of litigation who have undergone spinal fusion:

1. Those who have had an injury where they have sustained a spinal fracture which has been operated on with pedicle screw/rod fixation.
2. Those who may have suffered a disc injury/prolapse secondary to a particular injury or trauma that is the subject of litigation (a controversial subject in itself) and as part of their treatment have undergone discectomy and fusion.
3. Those who have had previous spinal fusion surgery for constitutional reasons and who now have an injury that is the subject of litigation.

In these people there is often discussion among spinal experts about the question of adjacent segment disease and whether the long-term prognosis for the claimant (and hence the level of their compensation) is affected by the prospect of further problems at these adjacent segments in the future or, in example three above, whether they would have had problems adjacent to the fusion anyway.

ADJACENT SEGMENT DISEASE (ASD)

Park et al[1] reviewed the literature on ASD looking at the definition, causation, incidence and risk factors associated with the condition. They defined ASD as degeneration at mobile segments above or below a fused segment. They reviewed 22 studies on ASD noting that they were all retrospective and uncontrolled, representing class III evidence. The incidence of ASD was found to range from 5.2% to 100%! However, the incidence of symptomatic ASD ranged between 5.2% and 18.5%. They noted an earlier onset of ASD after instrumented fusion when compared with uninstrumented fusion.

The concept that fusion causes accelerated ASD has been one of the reasons for the increasing use of disc replacement and so-called flexible stabilisation. Eckman et al[2] suggested that while ASD adjacent to a fusion was an issue, the clinical impact of the condition was minimal. Lee et al[3] defined ASD as the situation where a segment adjacent to a fusion becomes sufficiently troublesome to require surgical treatment. In a group of 1069 patients undergoing surgery there were 28 (2.6%) where further surgery at an adjacent segment had been required. Schulte et al[4] suggested that ten years after 360 degree fusion, disc height reduction at the adjacent segment was present but had no effect on the outcome for the patient.

RECENT RESEARCH

Mannion et al[5] combined data from four major randomised controlled trials where fusion was compared with non-operative treatment for low back pain. They obtained radiographs and patient-reported follow-up data at a mean of 13 years from surgery. There were 369 patients studied (272 fusion and 97 conservative), meaning that this was the largest group collected to assess the incidence of ASD after lumbar fusion. Presumably the numbers were higher in the surgically treated group because the conservatively treated patients were less willing to be followed up?

The fusion group had significantly greater loss of disc height at the two levels above the fusion as measured on a "validated computer-assisted distortion compensated" radiological technique. Patient-rated outcomes were measured using the Oswestry Disability Index (ODI) and pain scales. At a mean of 13 years from fusion there was no significant difference between the two groups in terms of patient-rated outcomes.

The authors concluded that although ASD was a proven risk of lumbar spinal fusion it was of no clinical relevance at 13 years from surgery. The paper was felt to be of sufficient stature and importance in the field of lumbar spinal research to be awarded the ISSLS (International Society for the Study of the Lumbar Spine) prize in 2014.

RELEVANCE TO CERVICAL SPINE

In the cervical spine, again it is widely accepted that ASD occurs after anterior cervical discectomy and fusion (ACDF). The clinical significance is controversial. Hilibrand et al[6] followed up a consecutive series of 374 patients

undergoing 409 ACDF procedures for up to 20 years after surgery. They reported that symptomatic ASD occurred in a quarter of the patients at ten years. Cho and Riew[7] also suggest that ASD occurs at approximately 3% per year after ACDF and therefore there would be an expected incidence of 25% within the first ten years after this procedure. However, Wu et al[8] from Taiwan reviewed a nationwide database including 19 385 patients who had undergone ACDF and at the ten-year point found that only 5.6% of patients had undergone a second procedure. They suggested a 0.8% annual incidence of ASD, considerably lower than the USA experience.

More recently, Xu et al[9] carried out a retrospective review of 888 consecutive patients who underwent ACDF at a single centre over a 20-year period. They found that 108 (12%) "developed ASD", requiring a second procedure, and 27 of these later developed "recurrent ASD" and underwent a third procedure.

Unfortunately there is no work of a comparable nature to Mannion's that would allow a similar comparison of clinical outcomes following ACDF. Clearly there is much less controversy over the indications for surgery (ACDF *vs* disc replacement aside) for cervical radiculopathy or myelopathy when compared with the debates and disagreements that surround fusion surgery for back pain. However, how much of the symptomatic ASD is constitutional and how much is related to biomechanical alterations at the adjacent segment/s is unclear. Anecdotally, my experience over the last 25 years of ASD following ACDF would be much closer to the Taiwanese experience than the USA experience.

It is too early, in 2014, to fully evaluate the long-term risk of ASD following cervical disc replacement (CDR). Yang et al[10] carried out a meta-analysis according to Cochrane guidelines and at that stage concluded that there was no evidence that CDR reduced the risk of ASD. Nunley et al[11] reviewed 167 patients who had undergone CDR with a median follow-up of four years and reported a 3.1% annual incidence of symptomatic ASD after CDR. However, Burkus et al[12] in a prospective, randomised multicentre trial comparing ACDF and CDR with seven years' follow-up found a re-operation rate of 11.9% *vs* 4.6%, respectively. The jury is still out and the results of further and longer-term studies are awaited.

CONCLUSIONS

As far as the lumbar spine is concerned I believe that the ISSLS prize-winning work of Mannion et al[5] puts us in a strong position to advise that the long-term outcome for patients/claimants is not going to be adversely affected by the fusion. It is most unlikely that there will be any significant long-term disability or that any further surgery will be required in the future and the claim can be settled.

With regard to the cervical spine the evidence is still contradictory and unclear concerning re-operation rates in particular. It is probably wise to advise that at ten years from ACDF there is a 5% to 25% likelihood of further adjacent segment surgery being required, supported, if appropriate, by reference to the reporting surgeon's personal experience.

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